IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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| Applicant | : Robert L. Turner et al. | Art Unit | : 1745 |
| Serial No. | : 10/630,501 | Examiner | : Raymond Alejandro |
| Filed | : July 30, 2003 | Conf. No. | : 7907 |
| Title | : AMORPHOUS MIXTURES OF ELECTROCHEMICALLY ACTIVE AND INACTIVE METAL ELEMENTS FOR USE AS ELECTRODE COMPOSITIONS | | |

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

TWICE AMENDED BRIEF ON APPEAL

This Twice Amended Brief on Appeal is in response to the second Notification of Non-Compliant Appeal Brief mailed on July 9, 2007. Although Applicants are unaware of any rule that prohibits Applicants from discussing the context of the claims in the "Summary of the Claimed Subject Matter" section, and disagree with the Examiner's characterization of that discussion, Applicants have amended the "Summary of the Claimed Subject Matter" section to remove the objectionable portions in the interests of advancing this appeal to the Board of Patent Appeals and Interferences. Accordingly, these portions have been moved to the "Argument" section. Applicants believe that this Twice Amended Brief on Appeal is now free of the "indicated deficiencies" or any other deficiency.

If the Examiner believes that this Twice Amended Brief on Appeal continues to contain procedural deficiencies, Applicants request that the Examiner include the appropriate objection in the Examiner's Answer, rather than in a third Notification of Non-Compliant Appeal Brief. This will prevent further delay and allow the Board of Patent Appeals and Interferences to consider the propriety of any additional procedural objections.

## (1) Real Party in Interest

The real party in interest is 3M Innovative Properties Co., Inc.

## (2) Related Appeals and Interferences

None.

**(3) Status of Claims**

Claims 1-10 and 15-17 are pending, stand finally rejected, and are appealed herein. Claims 11-14 have been canceled. This Appeal Brief is being filed following a Notice of Panel Decision from Pre-Appeal Brief Review mailed 12/7/06 that improperly failed to reverse the outstanding rejections and allow the pending claims.

**(4) Status of Amendments**

All amendments have been entered.

**(5) Summary of Claimed Subject Matter**

Independent claims 1 and 17 have been copied below to include references to the specification and/or drawings for each claim element:

1. An electrode composition (see e.g., specification, page 1, line 23 & page 4, line 24) comprising:

an electrode material consisting essentially of at least one electrochemically inactive elemental metal and at least one electrochemically active elemental metal in the form of an amorphous mixture at ambient temperature (see e.g., specification, page 1, line 29 – page 2, line 2) that remains amorphous when said electrode composition is incorporated into a lithium battery and cycled through at least one full charge-discharge cycle at ambient temperature (see e.g., specification, page 2, lines 3-5).

17. A lithium ion battery (see e.g., specification, page 3, line 8 & page 5, lines 1-2) comprising:

(a) a first electrode comprising an electrode material consisting essentially of at least one electrochemically inactive elemental metal and at least one electrochemically active elemental metal in the form of an amorphous mixture at ambient temperature (see e.g., specification, page 1, line 29 – page 2, line 2):

(b) a counterelectrode (see e.g., specification, page 5, lines 7 & 15-18); and

(c) an electrolyte (see e.g., specification, page 5, lines 7-14) separating said electrode and said counterelectrode, wherein said electrode material remains amorphous after said battery has been cycled through at least one full charge-discharge cycle (see e.g., specification, page 2, lines 3-5).

**(6) Grounds of Rejection to be Reviewed on Appeal**

The Examiner has rejected the claims on the ground that no fewer than 7 references each inherently discloses the claimed subject matter. The Examiner's position is incredible on its face, and presents the following issues for appeal:

(a) Whether JP 08-509022 **necessarily** and **unambiguously** discloses the subject matter of claims 1-10 and 15-17 such that JP 08-509022 inherently anticipates the claimed subject matter under 35 U.S.C. §102(b)?

(b) Whether JP 06-325764 **necessarily** and **unambiguously** discloses the subject matter of claims 1, 3-7, 9,and 17 such that JP 06-325764 inherently anticipates the claimed subject matter under 35 U.S.C. §102(b)?

(c) Whether JP 10-294112 **necessarily** and **unambiguously** discloses the subject matter of claims 1, 4-5, 7,and 17 such that JP 10-294112 inherently anticipates the claimed subject matter under 35 U.S.C. §102(b)?

(d) Whether JP 10-223221 **necessarily** and **unambiguously** discloses the subject matter of claims 1-10 and 17 such that JP 10-223221 inherently anticipates the claimed subject matter under 35 U.S.C. §102(b)?

(e) Whether EP 0209402 **necessarily** and **unambiguously** discloses the subject matter of claims 1-10 such that EP 0209402 inherently anticipates the claimed subject matter under 35 U.S.C. §102(b)?

(f) Whether EP 070359 **necessarily** and **unambiguously** discloses the subject matter of claims 1-6, 8, and 17 such that EP 070359 inherently anticipates the claimed subject matter under 35 U.S.C. §102(b)?

(f) Whether WO 99/49532 **necessarily** and **unambiguously** discloses the subject matter of claims 1-2, 4-5, 8, and 15-17 such that WO 99/49532 inherently anticipates the claimed subject matter under 35 U.S.C. §102(b)?

**(7) Argument**

*Discussion of the Claims*

The claims are directed towards an electrode composition suitable for use in a lithium-ion battery, and lithium-ion batteries that include this electrode composition (specification, page 1, lines 23-27). As set forth in the claims, the composition has both a defined chemical composition and a defined microstructure (i.e., the way in which the individual chemical constituents are arranged). Specifically, the claims require an electrode material consisting essentially of "at least one electrochemically inactive elemental metal" and "at least one electrochemically active elemental metal" (specification, page 1, line 28 to page 2, line 2). The specification provides specific examples of electrochemically inactive and electrochemically active elemental metals (specification, page 2, line 32 to page 3, line 7). The claims further require these elemental metals to be arranged in the form of an amorphous mixture at ambient temperature that remains amorphous when said electrode composition is incorporated into a lithium battery and cycled through at least one full charge-discharge cycle at ambient temperature (specification, page 2, lines 1-7).

Both the chemical composition and microstructure are important. In this regard, it is important to bear in mind that the same chemical constituents can be assembled at the atomic level in a variety of different ways, giving rise to compositions with different microstructures and, consequently, very different properties. A classic example of this phenomenon is the case of graphite and diamond. Both have exactly the same chemical composition because both consist solely of carbon. However, the manner in which those carbon atoms are put together varies significantly between graphite and diamond. The two materials, as a result, indisputably have very different properties.

The manner in which a composition is prepared affects its microstructure and, in particular, whether the resulting composition is crystalline or amorphous. This is a basic

principle of Materials Science. Thus, without knowing the details of how a composition was prepared, it simply is not possible to determine with certainty what its microstructure is.

These two principles (i.e., that the same chemical constituents can have different microstructures and that the method of manufacture affects microstructure) are important in analyzing the outstanding inherency-based rejections in this case. For the reasons discussed below, the Examiner based the rejections on the fact the prior art references disclosed compositions having some of the same chemical constituents as the claimed compositions, without establishing that these compositions also necessarily had the microstructure that Applicants' claims require.

*Discussion of the Law*

The law regarding inherency is clear. Mere probabilities and possibilities cannot, as a matter of law, establish anticipation based upon inherency:

> To establish inherency, the extrinsic evidence "must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." *Continental Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991). "Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *Id.* at 1269, 20 U.S.P.Q.2d at 1749 (quoting *In re Oelrich*, 666 F.2d 578, 581, 212 U.S.P.Q. 323, 326 (C.C.P.A. 1981)).

*In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999) (holding claims not inherently anticipated and reversing PTO Board of Appeals decision).

To similar effect is the Federal Circuit's decision in *Rosco, Inc. v. Mirror Lite Co.*, 304 F.3d 1373, 1380 (Fed. Cir. 2002):

> "Inherent anticipation requires that the missing descriptive material is 'necessarily present,' not merely probably or possibly present, in the prior art." (quoting *Trintec Indus., Inc. v. Top-U.S.A. Corp.*, 295 F.3d 1292, 1295, 63 U.S.P.Q.2d 1597, 1599 (Fed. Cir. 2002).

The Examiner's statements and actions throughout prosecution, however, reveal that he is basing the inherency rejections on probabilities and possibilities, in direct contradiction to the governing law:

> Assuming arguendo that there is no description of how the composition/material of the prior art was prepared, then the examiner contends that ***there is a substantially degree of probability*** that the process of making the composition/material of the prior art can produce a composition/material exhibiting a non-crystalline structure.
>
> * * *
>
> Don't you think that if it is impossible to determine whether or not the alloys are inherently amorphous, then, ***there is a reasonable certainty or expectation*** to believe the alloy disclosed in the prior art ***might in fact be amorphous***?
>
> * * *
>
> If applicant believes that is it more convenient to allow the present application in view of the impossibility of determining crystallinity or amorphousness of the disclosed material/composition [of the cited prior art], applicant then would be disappointed to learn the examiner does not share applicant's doctrine or vision.
>
> * * *
>
> [S]ince the manufacturing method might affect the final (or lack of) structure of the manufactured material [of the prior art], ***it is very difficult for the examiner to make a clear determination*** about the crystallinity and/or amorphousness of the material/composition in the prior art. ***The greatest uncertainty in this case*** is whether or not the JP '112, the JP '221 and the WO '532 do inherently teach the "amorphousness" of their materials.[1]

The Examiner's misunderstanding and misapplication of the law governing inherency underlie each of the 7 outstanding rejections, and compel reversal.

We turn now to a discussion of the individual rejections.

*Rejection of claims 1-10 and 15-17 under 35 U.S.C. §102(b) over JP 08-50922*

Claims 1-10 and 15-17 stand rejected under 35 U.S.C. §102(b) over JP 08-50922. JP 08-50922 describes anodes for rechargeable lithium batteries that may assume a variety of forms, one of which is an "alloy" of a metal that alloys with lithium and a metal that is unable to alloy with lithium. However, JP 08-50922 provides no further disclosure regarding the microstructure

[1] Advisory Action mailed 10/16/06, pp. 3, 4, and 5 (emphasis added).

of this "alloy," nor does it provide sufficient details regarding the manufacture of this "alloy" to enable a person of ordinary skill to determine its microstructure. Therefore, based upon the limited disclosure of JP 08-50922, it is impossible to determine whether these "alloys" are in the form of an amorphous mixture, as the claims require. Accordingly, because JP 08-50922 does not unequivocally and unambiguously describe an alloy in which the constituents are assembled in the form of an amorphous mixture, as the claims require, JP 08-50922 does not satisfy the standards for supporting a rejection under §102(b) based upon inherency. Consequently, the rejection must be reversed.

*Rejection of claims 1, 3-7, 9, and 17 under 35 U.S.C. §102(b) over JP 06-325764*

Claims 1, 3-7, 9, and 17 stand rejected under 35 U.S.C. §102(b) over JP 06-325764. JP 06-325764 describes a battery having a negative electrode that includes an "Al-Si-Fe alloy." All that JP 06-325764 discloses about this material is that it is an alloy. It does not describe the microstructure of the alloy, nor does it provide any information that would allow a person of ordinary skill to determine its microstructure, and thus whether it inherently included Al, Si, and Fe in the form of an amorphous mixture. In this regard, we note that JP 06-325764 fails to provide sufficient details regarding how the alloy was prepared to allow a person of ordinary skill to reproduce the alloy and determine its microstructure. Accordingly, JP 06-325764 does not unequivocally and unambiguously describe an alloy in which the constituents are assembled in the form of an amorphous mixture, as the claims require. JP 06-325764, therefore, does not satisfy the standards for supporting a rejection under §102(b) based upon inherency. Consequently, the rejection must be reversed.

*Rejection of claims 1, 4-5, 7, and 17 under 35 U.S.C. §102(b) over JP 10-294112*

Claims 1, 4-5, 7, and 17 stand rejected under 35 U.S.C. §102(b) over JP 10-294112. JP 10-294112 describes metal silicides for use as negative electrodes in lithium batteries. As stated in paragraph [0012], the metal silicides are in the from of an "intermetallic silicide." In addition, the compositions always include at least some crystalline material. In contrast, the pending claims call for a composition "consisting essentially of" electrochemically active and inactive elemental metals in the form of an amorphous mixture. The claims thus exclude both intermetallic compounds and crystalline materials. Accordingly, the claims exclude the

compositions described in JP 10-294112. Therefore, JP 10-294112 does not anticipate the claims, and the rejection must be reversed.

*Rejection of claims 1-10 and 17 under 35 U.S.C. §102(b) over JP 10-223221*

Claims 1-10 and 17 stand rejected under 35 U.S.C. §102(b) over JP 10-223221. JP 10-223221 describes materials for lithium battery electrodes in the form of amorphous or low crystallinity, intermetallic compounds. These compounds, according to JP 10-223221, are distinct from alloys. The claims, however, exclude intermetallic compounds by virtue of the "consisting essentially of" language included in each claim. JP 10-223221, therefore, does not anticipate the claims, and the rejection must be reversed.

*Rejection of claims 1-10 under 35 U.S.C. §102(b) over EP 0209402*

Claims 1-10 stand rejected under 35 U.S.C. §102(b) over EP 0209402. EP 0209402 describes aluminum alloys for use as anodes for electrochemical cells. It describes using a "conventional casting protocol" to produce the alloys. Such a method would not produce an amorphous alloy, as claims 1-10 require. Therefore, EP 0209402 does not anticipate claims 1-10, and the rejection must be reversed.

*Rejection of claims 1-6, 8, and 17 under 35 U.S.C. §102(b) over EP 070359*

Claims 1-6, 8, and 17 stand rejected under 35 U.S.C. §102(b) over EP 070359. EP 070359 describes two phase particles useful as anodes in a number of different types of rechargeable batteries, including lithium batteries. The particles can have a wide variety of compositions, including carbon, conductive polymers, metal oxides and sulfides, and "alloys," which may include intermetallic compounds. Nowhere, however, does EP 070359 describe the microstructure of the alloy in sufficient detail to enable a person of ordinary skill to determine whether or not it is in the form of an amorphous mixture. In fact, if anything, the processes described in Embodiments 1 and 10, which yield "alloys," include an annealing step characteristic of processes that produce crystalline material. Accordingly, because EP 070359 does not unequivocally and unambiguously describe an alloy in which the constituents are assembled in the form of an amorphous mixture, as the claims require, EP 070359 does not satisfy the standards for supporting a rejection under §102(b) based upon inherency. Consequently, the rejection must be reversed.

*Rejection of claims 1-2, 4-5, 8, and 15-17 under 35 U.S.C. §102(b) over WO 99/49532*

Claims 1-2, 4-5, 8, and 15-17 stand rejected under 35 U.S.C. §102(b) over WO 99/49532. WO 99/49532 describes compositions useful as anodes for lithium-ion batteries having a microstructure characterized by the presence of crystalline regions. This microstructure is very different from the amorphous mixture that the claims require. The "consisting essentially of" language included in each claim excludes the presence of such crystalline regions. WO 99/49532, therefore, does not anticipate the claims, and the rejection must be reversed.

*None of these References Necessarily and Unambiguously Discloses the Claimed Elements*

Not one of the 7 references upon which the Examiner relied necessarily and unambiguously discloses an electrode material having the chemical composition set forth in Applicants' claims in the form of an amorphous mixture, as the claims further require. As noted above, the Examiner substituted probabilities for certainties, and speculated as to what the references "might" disclose. In addition, the Examiner incorrectly based his conclusion of inherency over and over again on the scientifically incorrect assertion that "*products of identical chemical composition can not have mutually exclusive properties, and thus, the claimed characteristics (i.e. remaining an amorphous mixture), is necessarily present in the prior art material.*"[2] To rebut the Examiner's position, Applicants provided the simple, well-known, and undisputed example of graphite and diamond (described above) to illustrate how products of identical chemical composition can in fact have mutually exclusive structures and properties. This scientific evidence rebutted the Examiner's assertion and with it, the basis for the inherency rejections.

The Examiner never challenged the validity or scientific basis of the graphite/diamond example. Rather, his only response was to state that "we are not dealing with graphite or diamond."[3] This is true. It is also irrelevant. It shows that the Examiner completely missed the point of the example, which was to rebut the Examiner's assertion that products of identical chemical composition necessarily have the same properties.

The Examiner further stated that the

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[2] Office Action mailed 3/29/06, pp. 5, 6, 7, 8, 9, 11, and 12; Final Office Action mailed 8/17/06, pp. 4, 6, 8, 9, 10, and 11; Advisory Action mailed 10/16/06, p. 5.
[3] Final Office Action mailed 8/17/06, p. 12; Advisory Aetion mailed 10/16/06, p. 6.

> issue under contention is whether the all-encompassing limitations '*one electrochemically inactive elemental metal*' (which one? Indefinite) and '*at least one electrochemically active elemental metal*' (which one? Indefinite) can be take as any given representative composition that behaves as set forth by the applicant. The answer is NO, because applicant's classic example (i.e. graphite vs. diamond) calls for specific materials, compositions and crystalline microstructures, which are certainly quite different from applicant's claimed amorphous material. (emphasis in original).[4]

The above-quoted passage from the Examiner is improper and inaccurate for a number of reasons. First of all, it demonstrates that the Examiner was confusing the issue of definiteness under 35 U.S.C. §112 with the issue of inherency under 35 U.S.C. §102. The issue of definiteness has absolutely nothing to do with whether the material in the prior art references is amorphous or not. Secondly, the Examiner's assertion that the example of graphite vs. diamond is different because it calls for specific materials, compositions, and crystalline microstructures is plainly incorrect because the claim does recite specific compositions and calls for the composition to be amorphous. With respect to the composition, the claim calls for an electrochemically active elemental metal and an electrochemically inactive elemental metal. Both terms are defined in the specification. With respect to structure, defining the composition to be amorphous is a description of its microstructure, namely its lack of a crystalline structure. The specification clearly defines the term "amorphous mixture" on page 2 as being "a mixture that lacks the long range atomic order characteristic of crystalline material," which again is mutually exclusive with a crystalline structure.

In response to the Applicants' point that some of the references do not provide sufficient details regarding the manufacture of particular alloys, the Examiner argued that how the prior art products are made is irrelevant to the issue of inherency because "[p]atentability of a product does not depend on method of making the same."[5] The Examiner's statement, however, reflects a misunderstanding on his part regarding the relationship between a composition's microstructure and how it was made. The reason the Applicants discussed the lack of disclosure regarding how the prior art alloys were made is because it is well-known in the field of Materials Science that the manufacturing method affects whether the resulting composition is amorphous

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[4] Final Office Action mailed 8/17/06, p. 12.
[5] *Id.*, p. 13; Advisory Action mailed 10/16/06, pp. 5 and 7.

or crystalline. Because the cited references do not disclose sufficient details regarding how the alloys disclosed therein were prepared, it is impossible to determine whether or not the alloys were inherently amorphous. Under these circumstances, the doctrine of anticipation by inherency does not apply.

In response to the Applicants' comments regarding the JP '112, JP '221, and WO'532 prior art references, the Examiner argued that the claim language only requires that at least one of the electrochemically active elemental metals is required to be in a non-crystalline form. This makes no sense.[6] The Examiner obviously mis-read the claim. The language of claim 1 clearly requires the mixture to be amorphous.

*Conclusion*

The outstanding rejections based upon inherency are replete with legal and scientific errors. At no time during prosecution did the Examiner provide a supportable basis for establishing anticipation by inherency under the governing legal standards. Applicants rebutted each point the Examiner raised not with attorney argument, but with well-established, scientific evidence. These facts included the example of graphite and diamond to demonstrate that materials having the same chemical composition do not necessarily have the same structure and properties. They also included the self-evident, indisputable truth that the method of manufacturing a material influences its structure. Thus, a description of a material's chemical constituents, without a detailed description of its structure or the method used to prepare it, does not unambiguously define its structure. The outstanding rejections, therefore, are without basis, contrary to law, and must be reversed.

[6] Final Office Action mailed 8/17/06, p. 14; Advisory Action mailed 10/16/06, p. 8.

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Respectfully submitted,

Date: July 12, 2007

Dorothy P. Whelan
Reg. No. 33,814

Fish & Richardson P.C.
60 South Sixth Street
Suite 3300
Minneapolis, MN 55402
Telephone: (612) 335-5070
Facsimile: (612) 288-9696

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## Appendix of Claims

1. An electrode composition comprising:

an electrode material consisting essentially of at least one electrochemically inactive elemental metal and at least one electrochemically active elemental metal in the form of an amorphous mixture at ambient temperature that remains amorphous when said electrode composition is incorporated into a lithium battery and cycled through at least one full charge-discharge cycle at ambient temperature.

2. An electrode composition according to claim 1 wherein said electrode material consists essentially of at least one electrochemically inactive elemental metal and a plurality of electrochemically active elemental metals.

3. An electrode composition according to claim 1 wherein said electrode material consists essentially of plurality of electrochemically inactive elemental metals and at least one electrochemically active elemental metal.

4. An electrode composition according to claim 1 wherein said electrochemically active elemental metal is selected from the group consisting of aluminum, silicon, tin, antimony, lead, germanium, magnesium, zinc, cadmium, bismuth, and indium.

5. An electrode composition according to claim 1 wherein said electrochemically inactive elemental metal is selected from the group consisting of molybdenum, niobium, tungsten, tantalum, iron, nickel, manganese, and copper.

6. An electrode composition according to claim 1 wherein said electrochemically active elemental metal is aluminum.

7. An electrode composition according to claim 1 wherein said electrochemically active elemental metal is silicon.

8. An electrode composition according to claim 1 wherein said electrochemically active elemental metal is tin.

9. An electrode composition according to claim 1 where said electrochemically active elemental metals are aluminum and silicon.

10. An electrode composition according to claim 1 wherein said electrochemically active elemental metals are silicon and tin.

15. An electrode composition according to claim 1 wherein said composition is in the form of a thin film.

16. An electrode composition according to claim 1 wherein said composition is in the form of a powder.

17. A lithium ion battery comprising:

(a) a first electrode comprising an electrode material consisting essentially of at least one electrochemically inactive elemental metal and at least one electrochemically active elemental metal in the form of an amorphous mixture at ambient temperature:

(b) a counterelectrode; and

(c) an electrolyte separating said electrode and said counterelectrode, wherein said electrode material remains amorphous after said battery has been cycled through at least one full charge-discharge cycle.

## Evidence Appendix

None.

## Related Proceedings Appendix

None.